SECTION 31 23 23
FILL AND BACKFILL

PART 1 GENERAL

1.01 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. ASTM International (ASTM):
   a. C117, Standard Test Method for Materials Finer Than 75-Micrometers (No. 200) Sieve in Mineral Aggregates by Washing.
   b. C136, Standard Method for Sieve Analysis of Fine and Coarse Aggregates.
   c. D75, Standard Practice for Sampling Aggregates.
   d. D698, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft^3 (600 kN-m/m^3)).
   e. D1556, Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method.
   f. D1557, Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft^3 (2,700 kN-m/m^3)).
   g. D4253, Standard Test Methods for Maximum Index Density and Unit Weight of Soils Using a Vibratory Table.
   h. D4254, Standard Test Method for Minimum Index Density and Unit Weight of Soils and Calculation of Relative Density.
   i. D6938, Standard Test Methods for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).

1.02 DEFINITIONS

A. Relative Compaction:

1. Ratio, in percent, of as-compacted field dry density to laboratory maximum dry density as determined in accordance with ASTM D1557.
2. Apply corrections for oversize material to either as-compacted field dry density or maximum dry density, as determined by the Contracting Officer.

B. Optimum Moisture Content:

1. Determined in accordance with ASTM Standard specified to determine maximum dry density for relative compaction.
2. Determine field moisture content on basis of fraction passing 3/4-inch sieve.

C. Relative Density: Calculated in accordance with ASTM D4254 based on maximum index density determined in accordance with ASTM D4253 and minimum index density determined in accordance with ASTM D4254.

D. Prepared Ground Surface: Ground surface after completion of required demolition, clearing and grubbing, scalping of sod, stripping of topsoil, excavation to grade, and subgrade preparation.

E. Completed Course: A course or layer that is ready for next layer or next phase of Work.

F. Lift: Loose (uncompacted) layer of material.

G. Geosynthetics: Geotextiles, geogrids, or geomembranes.

H. Well-Graded:

1. A mixture of particle sizes with no specific concentration or lack thereof of one or more sizes.
2. Does not define numerical value that must be placed on coefficient of uniformity, coefficient of curvature, or other specific grain size distribution parameters.
3. Used to define material type that, when compacted, produces a strong and relatively incompressible soil mass free from detrimental voids.

I. Influence Area: Area within planes sloped downward and outward at 60-degree angle from horizontal measured from:

1. 1 foot outside outermost edge at base of foundations or slabs.
2. 1 foot outside outermost edge at surface of roadways or shoulder.
3. 0.5 foot outside exterior at spring line of pipes or culverts.

J. Selected Backfill Material: Materials available onsite that Contracting Officer determines to be suitable for specific use.

K. Imported Material: Materials obtained from sources offsite, suitable for specified use.

L. Embankment Material: Fill materials required to raise existing grade in areas other than under structures.

M. Standard Specifications: When referenced in this section, shall mean State of Connecticut Department of Transportation Form 816.

1.03 SUBMITTALS

A. Action Submittals:

1. Certified test results from independent testing agency.
2. Geotechnical testing results.

1.04 QUALITY ASSURANCE

A. Notify Contracting Officer when:

1. Soft or loose subgrade materials are encountered wherever embankment or site fill is to be placed.
2. Fill material appears to be deviating from Specifications.

1.05 SEQUENCING AND SCHEDULING

A. Complete applicable Work specified in Section 02 41 00, Demolition; Section 31 10 00, Site Clearing; Section 31 23 16, Excavation; and Section 31 23 13, Subgrade Preparation, prior to placing fill or backfill.

B. Backfill against concrete structures only after concrete has attained 70 percent of design strength. Obtain Contracting Officer's acceptance of concrete work and attained strength prior to placing backfill.

C. Do not place granular base, subbase, or surfacing until after subgrade has been prepared as specified in Section 31 23 13, Subgrade Preparation.

PART 2 PRODUCTS

2.01 SOURCE QUALITY CONTROL

A. Granular Materials:

1. As necessary to locate acceptable sources of imported material.
2. During production of imported material, test all granular materials in accordance with ASTM C136, "Standard Test Method for Sieve Analysis of Fine and Coarse Aggregate."

B. Cohesive Materials:

1. As necessary to locate acceptable sources of imported material.
2. During production, test as per ASTM D4318 and ASTM D1557.

2.02 EARTHFILL

A. Excavated cohesive material from excavations and approved by Contracting Officer after review of test results submitted by Contractor. Free from rocks larger than 3 inches, from roots and other organic matter, ashes, cinders, trash, debris, and other deleterious materials.

B. Material containing more than 10 percent gravel, stones, or shale particles is unacceptable.

C. Material with Plasticity Index (ASTM D4318) greater than 12 and liquid limit less than 50.

D. Provide imported material of equivalent quality, if required to accomplish Work.

2.03 GRANULAR FILL

A. 1-inch minus crushed gravel or crushed rock.

B. Free from dirt, clay balls, and organic material.

C. Well-graded from coarse to fine and containing sufficient fines to bind material when compacted, but with maximum 8 percent by weight passing No. 200 sieve.

2.04 SAND

A. As shown.

2.05 GRANULAR DRAIN MATERIAL

A. As specified in CONNDOT Standard Specifications Article M.01.01, Class 3.

2.06 WATER FOR MOISTURE CONDITIONING

A. Free of hazardous or toxic contaminates, or contaminants deleterious to proper compaction.

2.07 BASE COURSE ROCK

A. As specified in Standard Specifications.

2.08 FOUNDATION STABILIZATION ROCK

A. Crushed rock or pit run rock.

B. Uniformly graded from coarse to fine.

C. Free from excessive dirt and other organic material.

D. Maximum 2-1/2-inch particle size.

2.09 SOIL COVER OVER GEOTEXTILES—BIORETENTION AREA

A. Particle Size: Maximum 1 inch.

B. Free of sharp angular pieces that may damage geotextile.

2.10 SOIL COVER OVER GEOTEXTILES—RIP-RAP

A. Particle Size: Maximum particle size appropriate for function.

B. Free of sharp angular pieces that may damage geotextile.

PART 3 EXECUTION

3.01 GENERAL

A. Keep placement surfaces free of water, debris, and foreign material during placement and compaction of fill and backfill materials.

B. Place and spread fill and backfill materials in horizontal lifts of uniform thickness, in a manner that avoids segregation, and compact each lift to specified densities prior to placing succeeding lifts. Slope lifts only where necessary to conform to final grades or as necessary to keep placement surfaces drained of water.

C. Do not place fill or backfill, if fill or backfill material is frozen, or if surface upon which fill or backfill is to be placed is frozen.

D. If pipe, conduit, duct bank, or cable is to be laid within fill or backfill:

1. Fill or backfill to an elevation 2 feet above top of item to be laid.
2. Excavate trench for installation of item.

3. Install bedding, if applicable, as specified in Section 31 23 23.15, Trench Backfill.
4. Install item.
5. Backfill envelope zone and remaining trench, as specified in Section 31 23 23.15, Trench Backfill, before resuming filling or backfilling specified in this section.

E. Tolerances:

1. Final Lines and Grades: Within a tolerance of 0.1 foot unless dimensions or grades are shown or specified otherwise.
2. Grade to establish and maintain slopes and drainage as shown. Reverse slopes are not permitted.

F. Settlement: Correct and repair any subsequent damage to structures, pavements, curbs, slabs, piping, and other facilities, caused by settlement of fill or backfill material.

3.02 BACKFILL UNDER AND AROUND STRUCTURES

A. Under Facilities: Within influence area beneath structures, slabs, pavements, curbs, piping, conduits, duct banks, and other facilities, backfill with granular fill, unless otherwise shown. Place granular fill in lifts of 6-inch maximum thickness and compact each lift to minimum of 95 percent relative compaction as determined in accordance with ASTM D1557.

B. Subsurface Drainage: Backfill with granular drain material, where shown. Place granular drain material in lifts of 6-inch maximum thickness and compact each lift to minimum of 90 percent relative density.

C. Other Areas: Backfill with earthfill to lines and grades shown, with proper allowance for topsoil thickness where shown. Place in lifts of 6-inch maximum thickness and compact each lift to minimum 90 percent relative compaction as determined in accordance with ASTM D1557.

3.03 FILL—BERM—COHESIVE MATERIALS

A. Unless otherwise shown, place earthfill for berms as follows:

1. Allow for 6-inch thickness of topsoil where required.
2. Maximum 8-inch thick lifts.
3. Place and compact fill across full width of embankment.
4. Compact to minimum 90 percent relative compaction as determined in accordance with ASTM D1557. If any two of the four most recent tests

falls below 90 percent or any one of the four preceding tests falls below 88 percent, additional compactive effort will be required.

5. Dress completed embankment with allowance for topsoil, crest surfacing, and slope protection, where applicable.

3.04 FILL—AGGREGATE

A. Compact until no additional compaction is apparent.

3.05 SITE TESTING

A. Geotechnical Testing:

1. Contractor to drill two soil borings in the footprint of the Bioretention Area (Building 16 Demolition Area) and one boring in the footprint of East Pond Ditch Excavation. Soil borings to extend to a depth of 10 feet below existing ground surface. Each boring shall be extended using either hollow-stem or solid-stem augers. Soil samples shall be obtained at 2.5-foot intervals in accordance with ASTM D1586, "Standard Procedures for Penetration Test and Split-Barrel Sampling of Soils." Representative portions of samples shall be retained in sealed jars. Soil boring logs containing the method of borehole advancement, sample depths, sampler blow counts for 6-inch intervals, length of sample recovery, visual classification and description of soil samples, and groundwater levels both during and after drilling completion shall be provided to the Contracting Officer with 24 hours after drilling completion.
2. Contractor to provide laboratory soil testing as follows for sample locations agreed upon with the Contracting Officer:
   a. Water Content (ASTM D2216): 10 tests.
   b. Atterberg Limits (ASTM D4318): 2 tests.
   c. Particle Size Analyses (sieve) (ASTM D422): 2 tests.
3. Upon mobilization to site, Contractor shall obtain bulk sample of soil in the footprint of the Bioretention Area (Building 16 Demolition Area) and provide one modified proctor density test (ASTM D1557). Contractor shall submit results of the modified proctor test to the Contracting Officer for approval prior to commencement of earthwork activities.

B. Gradation Granular Materials:

1. One sample from each 100 tons of finished product or more often as determined by Engineer, if variation in gradation is occurring, or if material appears to depart from Specifications.

2. If test results indicate material does not meet Specification requirements, terminate material placement until corrective measures are taken.
3. Remove material placed in Work that does not meet Specification requirements.

C. Cohesive Materials:

1. One Atterberg Limit Test (ASTM D4318) and one Modified Proctor Test (ASTM D1557) per material type and material source.
2. If test results indicate material does not meet Specification requirements, terminate material placement until corrective measures are taken.
3. Remove material placed in Work that does not meet Specification requirements.

D. In-Place Density Tests: In accordance with ASTM D1556. During placement of materials, test as follows:

1. Cohesive Fill (berm materials).

3.06 GRANULAR BASE, SUBBASE, AND SURFACING

A. Place and Compact as specified in Standard Specifications.

3.07 REPLACING OVEREXCAVATED MATERIAL

A. Replace excavation carried below grade lines shown or established by Contracting Officer as follows:

1. Beneath Fill or Backfill: Same material as specified for overlying fill or backfill.
2. Trenches:
   a. Unauthorized Overexcavation: Either trench stabilization material or granular pipe base material, as specified in Section 31 23 23.15, Trench Backfill.
   b. Authorized Overexcavation: Trench stabilization material, as specified in Section 31 23 23.15, Trench Backfill.
3. Permanent Cut Slopes (Where Overlying Area is Not to Receive Fill or Backfill):
   a. Flat to Moderate Steep Slopes (3:1, Horizontal Run: Vertical Rise or Flatter): Earthfill.
   b. Steep Slopes (Steeper than 3:1):
      1) Correct overexcavation by transitioning between overcut areas and designed slope adjoining areas, provided such

cutting does not extend offsite or outside easements and right-of-ways, or adversely impacts existing facilities, adjacent property, or completed Work.

2) Backfilling overexcavated areas is prohibited, unless in Engineer's opinion, backfill will remain stable, and overexcavated material is replaced as compacted earthfill.

3.08 PLACING FILL OVER GEOSYNTHETICS

A. General:

1. Place fill over geosynthetics with sufficient care so as not to damage them.
2. Place fill only by back dumping and spreading only.
3. Dump fill only on previously placed fill.
4. While operating equipment, avoid sharp turns, sudden starts or stops that could damage geosynthetics.

B. Hauling: Operate hauling equipment on minimum of 3 feet of covering.

C. Spreading:

1. Spreading equipment shall be track mounted.
2. Operate spreading equipment on minimum of 12 inches of fill over geosynthetics.
3. Spread fill in same direction as unseamed overlaps to avoid separation of seams and joints.
4. Never push fill downslope. Spread fill over sideslopes by pushing up from slope bottom. If access to bottom of slope is unavailable, progressively place fill, beginning at toe of slope and working upslope, with backhoe or dragline operated from top of slope. Limit distance material falls onto the geosynthetics to maximum of 2 feet.
5. Flatten wrinkles of geotextiles, in direction of spreading. Correct wrinkles in geotextiles as specified in Section 31 32 19.16, Geotextile.
6. Maintain proper overlap of unseamed geosynthetics.
7. Avoid overstressing geosynthetics and seams.

D. Compaction: Compact fill only after uniformly spread to full thickness shown.

E. Geosynthetic Damage:

1. Mark punctures, tears, or other damage to geosynthetics, so repairs may be made.
2. Clear overlying fill as necessary to repair damage.

3. Repairs to geosynthetics shall be made by respective installers as specified in respective specification section for each geosynthetic.

END OF SECTION